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**Notes:**

1. Untranslatable words are replaced with asterisks (\*\*\*).
2. Texts in the figures are not translated and shown as it is.

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**CLAIM + DETAILED DESCRIPTION**

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**[Claim(s)]**

[Claim 1]A dicing sheet which can be provided with the following, can cut said adhesive layer with said laser beams, and is characterized by the ability not to cut said support sheet with said laser beams.

A substrate which is a dicing sheet for carrying out support fixation of said workpiece when using laser beams and cutting a workpiece, and contains a support sheet.

An adhesive layer arranged on the single-sided surface of said substrate.

[Claim 2]The dicing sheet according to claim 1 which is a layered product characterized by comprising the following, and is characterized by stationing said intermediate layer between said adhesive layer and said support sheet.

Said substrate is said support sheet.

An intermediate layer who can cut with said laser beams.

[Claim 3]The dicing sheet according to claim 1 or 2 in which said support sheet is characterized by the degree of fracture growth being not less than 100%, and fracture stress being  $50\text{-}30000\text{N/m}^2$ .

[Claim 4]The dicing sheet according to any one of claims 1 to 3 characterized by ultraviolet-rays transmissivity of said substrate being not less than 10% by said adhesive layer consisting of an ultraviolet curing type adhesive layer.

[Claim 5]A method of cutting a workpiece using laser beams and forming a chip, comprising:

A substrate containing a support sheet which cannot be cut with laser beams.

It is arranged on the single-sided surface of said substrate, and is an adhesive layer which can be cut with said laser beams.

[Claim 6]The dicing method according to claim 5 extending a dicing sheet, and estranging and taking up each chip mutually after cutting said workpiece and cutting a chip.

[Claim 7]The dicing method according to claim 5 or 6, wherein a workpiece is a semiconductor wafer.

[Claim 8]The dicing method according to any one of claims 5 to 7 using laser beams by water jet laser.

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to a dicing sheet and a dicing method.

[0002]

[Description of the Prior Art]Dicing processing is generally used for cutting of a semiconductor wafer. When carrying out dicing of the semiconductor wafer, it cuts in the form which performs rotation with a high-speed dicing blade, and excavates a dicing line. The detailed chip (chipping) occurred in the cutting plane, and there was a problem that this lowered the reliability of a semiconductor chip. On the other hand, in order that the laser processing using laser beams may not apply physical load to a workpiece, a cutting plane is finished finely. Laser processing is processible into complicated shape by extracting the path of light by being able to perform detailed processing to a workpiece, and also changing the locus of light. For this reason, laser dicing which uses laser beams for cutting processing of a semiconductor wafer is examined. By the way, since it is a brittle substance with a minute semiconductor chip after being cut when processing a semiconductor wafer as a workpiece, cautions are extremely required for subsequent handling. Where [ then, ] it stuck the semiconductor wafer on pressure sensitive adhesive tape and the pressure sensitive adhesive tape is fixed to a support frame from the former, The semiconductor wafer on pressure sensitive adhesive tape is cut (namely, dicing), and it conveys in the state of a support frame, sticking the semiconductor chip after cutting on pressure sensitive adhesive tape, and the next processing is performed. Therefore, the semiconductor chip after cutting does not become scattering, but the breakage in the case of conveyance also has them. [ few ] However, in the conventional laser processing, cutting a workpiece in the state where it supported on the base material is not carrying out. On the other hand, since pressure sensitive adhesive tape will also be completely cut if laser processing is carried out using the usual pressure sensitive adhesive tape, it was not fit for minute processing which is cut from the above-mentioned semiconductor wafer to a chip. Even if it uses the material which cannot be cut in laser beams as a material of pressure sensitive adhesive tape, since the boundary of a workpiece and pressure sensitive adhesive tape serves as high temperature very much, pressure sensitive adhesive tape

transforms it locally, and precise processing becomes impossible.

[0003]

[Problem to be solved by the invention]So that it may cut to a cutting plane, and it may be hard to generate \*\*\*\* and conveyance after a cutting process and processing of a next process can be performed easily, when cutting workpieces, such as a semiconductor wafer, using laser beams, [ the technical problem of this invention ] It is in providing the dicing sheet for laser dicing which can fix a workpiece, and the method of carrying out laser dicing of the workpiece using this dicing sheet.

[0004]

[Means for solving problem]The substrate which is a dicing sheet for carrying out support fixation of said workpiece when laser beams are used for this invention and a workpiece is cut, and contains a support sheet, It can consist of an adhesive layer arranged on the single-sided surface of said substrate, said laser beams can cut said adhesive layer, and said support sheet is related with the dicing sheet being unable to cut with said laser beams. In the desirable mode of the dicing sheet by this invention, said substrate is a layered product including said support sheet and the intermediate layer who can cut with said laser beams, and said intermediate layer is stationed between said adhesive layer and said support sheet. In another desirable mode of the dicing sheet by this invention, the degree of fracture growth is not less than 100%, and the fracture stress of said support sheet is  $50\text{-}30000\text{-N/m}^2$ . In another desirable mode of the dicing sheet by this invention, said adhesive layer consists of an ultraviolet curing type adhesive layer, and the ultraviolet-rays transmissivity of said substrate is not less than 10%.

[0005]In the method of this invention cutting a workpiece using laser beams, and forming a chip, It is arranged on the single-sided surface of the substrate containing the support sheet which cannot be cut with laser beams, and said substrate, Stick the dicing sheet which consists of an adhesive layer which can be cut with said laser beams on the whole surface of a workpiece, carry out support fixation, and it irradiates with laser beams to said workpiece, Said workpiece and said adhesive layer are cut and it is related also with the dicing method cutting off said support sheet partially at least. In the desirable mode of the dicing method by this invention, after cutting said workpiece and cutting a chip, a dicing sheet is extended, and each chip is estranged and taken up mutually. In another desirable mode of the dicing method by this invention, a workpiece is a semiconductor wafer. In another desirable mode of the dicing method by this invention, the laser beams by water jet laser are used.

[0006]

[Mode for carrying out the invention]The dicing sheet by this invention consists of a layered product of an adhesive layer and a substrate. That the aforementioned substrate consists of (1) support sheet, for example can also consist of (2) support sheets and an intermediate layer

(and adhesives layer between them). A substrate calls hereafter the mode which consists of support sheets a "substrate un-cutting type dicing sheet", the mode which a substrate becomes from a support sheet and an intermediate layer (and adhesives layer between them) is called a "substrate half cutting type dicing sheet", and the specific mode of this invention is explained.

[0007]In a dicing process, the aforementioned substrate un-cutting type dicing sheet by this invention is completely cut from the upper surface to the undersurface about an adhesive layer, and using in the mode to cut off partially is preferred about a substrate (namely, support sheet). On the other hand, in a dicing process, the aforementioned substrate half cutting type dicing sheet by this invention is completely cut from the upper surface to the undersurface about an adhesive layer and an intermediate layer, and it is preferred to use in the mode cut off partially about the support sheet of said substrate.

[0008]Hereafter, the aforementioned substrate un-cutting type dicing sheet and the aforementioned substrate half cutting type dicing sheet by this invention are explained in order over an accompanying drawing. Drawing 1 is a sectional view showing typically the fundamental mode of the substrate un-cutting type dicing sheet 10 by this invention. The substrate un-cutting type dicing sheet 10 shown in drawing 1 is provided with the following. Support sheet 21 (namely, substrate 2).

The adhesive layer 3 provided on the single-sided surface.

Therefore, the dicing sheet 10 consists of two-layer structure as a whole. In the substrate un-cutting type dicing sheet 10, Said adhesive layer 3 is laser-beams endergonic nature (that is, cutting with the laser beams which cut a workpiece is possible), Said support sheet 21 (namely, substrate 2) is laser-beams energy unabsorbent (that is, cutting depending on the laser beams which cut a workpiece is impossible).

[0009]Drawing 3 is a sectional view showing typically the fundamental mode of the substrate half cutting type dicing sheet 11 by this invention. The substrate 2 consists of the intermediate layer 22 and the support sheet 23 including the adhesive layer 3 which formed the substrate half cutting type dicing sheet 11 shown in drawing 3 the substrate 2 and on the single-sided surface. The adhesive layer 3 contacts the intermediate layer 22, and is arranged on it.

Therefore, the dicing sheet 11 consists of three-tiered structures as a whole. In the substrate half cutting type dicing sheet 11, Said adhesive layer 3 is laser-beams endergonic nature (that is, cutting with the laser beams which cut the semiconductor wafer 4 is possible), The intermediate layer 22 who contacts said adhesive layer 3 among said substrates 3 is laser-beams endergonic nature (.). that is, cutting with the laser beams which cut the semiconductor wafer 4 is possible -- it is -- the support sheet 23 is laser-beams energy unabsorbent (that is, cutting with the laser beams which cut the semiconductor wafer 4 is impossible). When having pasted up via adhesives, the intermediate layer 22 and the support sheet 23, [ this adhesives

layer ] It can also be laser-beams energy unabsorbent (that is, cutting with the laser beams which cut the semiconductor wafer 4 is impossible) that it is laser-beams endergonic nature (that is, cutting with the laser beams which cut the semiconductor wafer 4 is possible).

[0010]In the dicing sheet of this invention, the adhesive layer which can be cut with the laser beams which cut a workpiece is used. such an adhesive for adhesive layers -- (\*\*)-- as the adhesive which contains in a pressure sensitive adhesive ingredient the additive agent (an absorbency grant agent may be called hereafter) which absorbs the wavelength of laser beams, or a compound which constitutes a (\*\*) pressure sensitive adhesive ingredient, The adhesive containing the compound which combined the functional group which absorbs the wavelength of laser beams can constitute. It can choose from the compound which constitutes a general-purpose pressure sensitive adhesive as a pressure sensitive adhesive ingredient, for example, a rubber system, acrylic, a silicone series, a urethane system, a polyester system, polyvinyl ether system adhesives, etc. can be mentioned.

[0011]An absorbency grant agent consists of a substance which absorbs the energy of a specific wavelength area. The substance which can absorb the energy of the same wavelength area as the wavelength of the laser beams to be used besides colorant, such as paints and dye, as such a substance, for example can be mentioned. [ for example YAG (yttrium aluminum garnet) laser ] Since it oscillates at 1064 nm of a near-infrared field, [ as an absorbency grant agent in the case of using YAG as laser beams ] The infrared resonance agent of organic systems, such as a cyanine system compound, a SUKOWARIRIUMU system compound, a phthalocyanine system compound, tin oxide, antimony dope tin oxide (ATO), or tin dope indium oxide (ITO), or an inorganic system can be mentioned. The functional group which has an absorption field near the wavelength of the laser beams which cut a workpiece may be combined with the side chain of the polymer component which constitutes a pressure sensitive adhesive. Since the wavelength area of visible light including the infrared region outside purple can be absorbed if black paints and/or dye are used as an absorbency grant agent of laser beams, it is not necessary to change composition of an adhesive with change of the wavelength of laser beams. When the additive which constitutes a pressure sensitive adhesive ingredient like the pressure sensitive adhesive ingredient itself or adhesion grant agent resin is coloring, since the absorptivity of laser beams comes out enough and there is a certain case, the absorbency grant agent in particular does not need to use it.

[0012]An adhesive layer can also be formed from an ultraviolet curing type adhesive. As an ultraviolet curing type adhesive, the constituent which blended the ultraviolet curing nature ingredient and the photoinitiator, and also the absorbency grant agent of the above-mentioned laser beams with the above-mentioned pressure sensitive adhesive ingredient can be mentioned. As an ultraviolet curing nature ingredient, the low-molecular compound which has a double bond of polymerization nature can be mentioned in a molecule, For example,

trimethylolpropane triacrylate, PENTA erythritol tetraacrylate, PENTA erythritol triacrylate, dipentaerythritol hexaacrylate, Dipentaerythritolmonohydroxypentaacrylate, 1, 4-butylene glycol diacrylate, 1, 6-hexanediol diacrylate, poly ethylene glycol diacrylate, Oligoester acrylate, a polyester type or polyol type urethane acrylate oligomer, polyester acrylate, polyether acrylate, epoxy denaturation acrylate, etc. can be used.

[0013]It can also be considered as an ultraviolet curing nature ingredient using the polymer component which combined the functional group which had a double bond of polymerization nature in the side chain as a polymer component of a pressure sensitive adhesive ingredient. As such a photoinitiator, a benzoin compound, the aceto FENON compound, An ASHIRU phosphine oxide compound, a titanocene compound, a thioxan ton compound, Can mention feeling agents of \*\*\*\*, such as photoinitiators, such as a peroxide compound, amine, and quinone, etc., and specifically, 1-hydroxy cyclohexyl phenyl ketone, benzoin, benzoin methyl ether, Benzoin ethyl ether, benzoin iso-propyl ether, BENJIRU diphenyl sulfide, tetramethylthiuram monosulfide, azobis isobutyronitrile, JIBENJIRU, Gia Sept Iles, beta-craw ANSURA quinone, etc. can be illustrated.

[0014]If an absorbency grant agent is blended with a pressure sensitive adhesive ingredient, the absorptivity of the wavelength of laser beams will increase. The portion with which laser beams were irradiated absorbs energy, a high fever is generated at the moment, thermal cracking is caused, and cutting becomes possible by this. The compounding ratio of the absorbency grant agent in an adhesive layer will not be limited especially if cutting with laser beams is possible for an adhesive layer. That is, cutting becomes possible even if the absorptivity of the wavelength of laser beams is low, if the output of laser beams is large or spot irradiation time excels. Usually, it is blended so that the transmissivity in the wavelength of laser beams may be 80% or less. Although the thickness in particular of an adhesive layer is not limited, either, it is usually 1-100 micrometers, and is 5-50 micrometers preferably.

[0015]The support sheet in the dicing sheet of this invention is a sheet which cannot be cut with the laser beams which cut a workpiece, and can be chosen from the free-standing sheet conventionally formed from publicly known resin. Specifically Low density polyethylene, straight chain low density polyethylene, high-density polyethylene, Extension polypropylene, non-extending polypropylene, an ethylene propylene copolymer, An ethylene-vinyl acetate copolymer, an ethylene (meta) acrylic acid copolymer, An ethylene (meta) acrylic ester copolymer, polyethylene terephthalate, The sheet which consists of polyethylenenaphthalate, polyvinyl chloride, polyurethane, polyamide, polystyrene, polycarbonate, polyimide, eye ONOMA, or a fluoro-resin can be mentioned. A support sheet may be a double layer, unless it can cut as a whole even if it is a monolayer or. The thing of various shape, such as the shape of a film and mesh state, can be chosen. Since water may be used like [ in laser dicing ] the after-mentioned, the waterproof thing of a support sheet is preferred.

[0016]A support sheet is chosen so that it may become unabsorbent to the laser beams which cut a workpiece. Unabsorbent can mention the case where it is permeability, and the case where it is reflexivity, to the wavelength of the laser beams used to laser beams. For the transmissivity to change with the outputs and spot irradiation time of laser beams, when it is permeability, but what is necessary is just usually not less than 85%. A reflexible support sheet can be prepared by forming a metal thin film in the adhesive formation side side by vapor deposition or sputtering. Since total internal reflection of the laser beams is carried out by the metal thin film and a support sheet is not passed, a support sheet is not cut.

[0017]The degree of fracture growth is not less than 100%, and the fracture stress of the support sheet used for the dicing sheet of this invention is usually  $50-50000\text{N/m}^2$ . The degree of fracture growth is not less than 100%, and fracture stress, [ the support sheet of  $50 - 50000\text{N/m}^2$  ] Since it can collect without damaging the chip of a workpiece since it becomes easy to estrange the chip which extended the dicing sheet, and cut and formed the workpiece after performing laser dicing, it is desirable. A support sheet can be pushed out and can be formed by film production or cast film production. Although the thickness in particular is not limited, it is usually 30-300 micrometers, and is 50-100 micrometers preferably.

[0018]The dicing sheet of this invention can also have the structure which forms the above-mentioned adhesive layer on said intermediate layer using the substrate of the double layer in which the intermediate layer who can cut with said laser beams was formed on the support sheet which cannot be cut with the laser beams which cut a workpiece. When it has such a structure, it can cut deeply, without changing the thickness of an adhesive layer and the depth can be enlarged to take the large depth of the cut by laser beams. If thickness of an adhesive layer is thickened too much, re-fissility is inferior, and when exfoliating from a dicing sheet, stiffness of paste may generate the chip formed from a workpiece. Therefore, the thickness of an adhesive layer can be suitably chosen now by providing an intermediate layer in the dicing sheet of this invention.

[0019]An intermediate layer is obtained by adding the same substance as the substance enumerated as an absorbency grant agent used for the above-mentioned adhesive layer to the resin used for the above-mentioned support sheet. Although the transmissivity in an intermediate layer changes with the outputs and spot irradiation time of laser beams, what is necessary is just usually 80% or less. Although an intermediate layer's thickness in particular is not limited, it is usually 10-100 micrometers preferably 5-200 micrometers. When using the adhesive layer of the dicing sheet of this invention as an ultraviolet curing type, the ultraviolet-rays transmissivity of a substrate constitutes not less than 10% so that it may become not less than 30% preferably. If it does in this way, sufficient ultraviolet rays for an adhesive layer can reach, an adhesive layer can be hardened, adhesive strength at the time of exfoliating the chip formed from a workpiece can be made very small, and influence which it has on the chip

formed from a workpiece can be lessened.

[0020]As the film production method of a substrate, extrusion film production and after carrying out cast film production, a support sheet and an intermediate layer may be pasted together with adhesives, and may be formed by co-extrusion, respectively. After pushing out one side and producing a film or cast producing a film, cast film production may be carried out on the field which produced another side. With laser beams, the adhesives itself can be cut, or it is not cut, and what is necessary is just to set it up so that the thickness which can be cut may agree for the above-mentioned purpose when laminating using adhesives.

[0021]As a workpiece applicable to this invention, as long as cut treating can be carried out with laser beams, there is no limitation in the material, for example, various articles, such as charges of a metallic material, such as organic-materials boards, such as a semiconductor wafer, a glass substrate, a ceramic substrate, and FPC, or a precision component, can be mentioned. The shape before cutting is tabular, and the size after cutting is small, and if scattering, the dicing tape and dicing method of this invention are more effective to a workpiece from which handling becomes difficult.

[0022]Laser is a device to generate the light to which the wavelength and the phase were equal, and YAG (wavelength = 1064 nm), Or gas lasers, such as solid-state lasers, such as a ruby (wavelength = 694 nm), or argon ion laser (wavelength = 1930 nm), etc. are known, and those various laser can be used in this invention. As a laser dicing apparatus which can be used by this invention, as shown in drawing 5, it irradiates with laser-beams L so that a focus may suit to the cutting part C of a workpiece (for example, semiconductor wafer 4), and there is a device which cuts a workpiece, for example. As for the cutting plane since laser beams spread in the depth [ focus ] shifted and energy density was small this device, after being processed, accuracy falls a little. That is, a cutting plane (wall surface of the slot 5) curves slightly (drawing 5 is a typical expanded sectional view for the slot at the time of using the substrate un-cutting type dicing sheet 10 shown in drawing 1, for explanation, exaggerates a curve state and is illustrated). When using such a device, it is preferred to perform control of a focal position, thickness adjustment of an adhesive layer, etc. so that a workpiece may not be affected to the above curve cutting planes by influence.

[0023]On the other hand, as shown in drawing 6, it irradiates with perpendicularly parallel laser beams, and the laser beam machining device (water-jet laser: water jet guided laser) which raised the processing accuracy of the cutting plane (wall surface of the slot 5) is proposed. This device passes a narrow water jet on the cutting line of a workpiece (for example, semiconductor wafer 4), passes laser beams and is making the cutting line irradiate with the inside of this water jet. This device is explained by JP,H10-500903,A in full detail, and is sold by SYNOVA (Switzerland) by the brand name of "Laser mu Jet", for example. The laser dicing method of this invention is applicable to any above device.



[0024]Next, the laser dicing method of this invention is explained. The laser dicing method of this invention can be enforced using the laser dicing sheet of this invention. First, the adhesive layer of the dicing sheet by above-mentioned this invention is stuck on the whole surface of a workpiece. Under the present circumstances, a dicing sheet uses a larger thing than the pasting side of a workpiece, and sticks the peripheral part of a dicing sheet on the frame for conveyance. A workpiece is supported by the frame and carried in a laser dicing apparatus in this state. It irradiates with laser beams to one on the cutting line provided on the workpiece. The relative position of a workpiece and laser beams is gradually shifted along with the cutting line with irradiation. Thereby, along with a cutting line, laser beams are irradiated with a workpiece and it is cut. At this time, laser beams decompose thermally in an instant and cut the adhesive layer (this intermediate layer when [ and ] it has an intermediate layer who can cut with laser beams by a case) of a workpiece and a dicing sheet. A support sheet penetrates or reflects laser beams, and it is not cut in order not to absorb energy.

[0025]In carrying out dicing processing of the semiconductor wafer 4 using the dicing sheet 10 shown in drawing 1, as shown in drawing 2, it sticks the semiconductor wafer 4 on the adhesive layer 3. Then, it irradiates with laser beams from the upper part of the semiconductor wafer 4 (from the direction of the arrow B of drawing 2), the semiconductor wafer 4 is cut for each chip 4', and the slot 5 is formed. under the present circumstances -- cutting to a cutting plane and lacking, since load of stress like [ in the case of using a dicing blade ] is not carried out to the semiconductor wafer 4 -- etc. -- it does not generate but a smooth cutting plane is formed.

[0026]After laser beams cut the semiconductor wafer 4, they pass said adhesive layer 3, and also pass said support sheet 21 (namely, substrate 2). To the laser beams which cut the semiconductor wafer 4, since it is endergonic nature, it generates heat and said adhesive layer 3 is cut. On the other hand, to the laser beams which cut the semiconductor wafer 4, since it is energy unabsorbent, said support sheet 21 (namely, substrate 2) does not generate heat, therefore is not cut. Thus, in the dicing sheet 10 by this invention, since said support sheet 21 (namely, substrate 2) is cut off partially to the slot 5 being formed in said adhesive layer 3, at the following expanded process, the dicing sheet 10 can be extended and an adjoining chip can be estranged.

[0027]In using the dicing sheet 11 shown in drawing 3, as shown in drawing 4, it sticks the semiconductor wafer 4 on the adhesive layer 3. Then, it irradiates with laser beams from the upper part of the semiconductor wafer 4 (from the direction of the arrow B of drawing 4), the semiconductor wafer 4 is cut for each chip, and the slot 5 is formed. under the present circumstances -- cutting to a cutting plane and lacking, since load of stress like [ in the case of using a dicing blade ] is not carried out to the semiconductor wafer 4 -- etc. -- it does not generate but a smooth cutting plane is formed.

[0028]After they cut the semiconductor wafer 4, laser beams pass said adhesive layer 3, and also said substrate 2 reaches intermediate-layer 22, and continue, and pass the support sheet 23. To the laser beams which cut the semiconductor wafer 4, since it is endergonic nature, it generates heat and said adhesive layer 3 is cut. To the laser beams with which the intermediate layer 22 of said substrate 2 also cut the semiconductor wafer 4, since it is endergonic nature, it is generated heat and cut. On the other hand, to the laser beams which cut the semiconductor wafer 4, since it is energy unabsorbent, the support sheet 23 of said substrate 2 does not generate heat, therefore is not cut. Thus, since the support sheet 23 of said substrate 2 is cut off partially by said adhesive layer 3 and the intermediate layer 22 of said substrate 2 to the slot 5 being formed, [ the dicing sheet 11 by this invention ] At the following expanded process, the dicing sheet 11 can be extended and adjoining chips can be estranged.

[0029]When both a substrate and an adhesive layer use the dicing sheet which penetrates laser beams instead of the dicing sheet of this invention, the following faults occur. For example, since the portion cut by laser beams serves as a high fever when using the dicing apparatus which generates the laser beams shown in drawing 5 as a laser dicing apparatus, modification of the adhesive layer side which touches the portion from which the workpiece was cut occurs easily with heat. For this reason, there is a possibility that support of the chip after cutting may become insufficient. However, if the dicing sheet of this invention is used, the place which excessive heat generates will serve as an interface of an adhesive layer and a support sheet, or its neighborhood, without being decomposed by laser beams. In this case, since the workpiece and the portion changed with heat are mutually separated, the processing aptitude of a workpiece is not affected.

[0030]Both a substrate and an adhesive layer use the dicing sheet which penetrates laser beams instead of the dicing sheet of this invention, and it, [ as a laser dicing apparatus ] When the water jet laser shown in drawing 6 is used, Although the water of a water jet acts as cooling water and an adhesive layer does not carry out heat modification, The place to go to of water is lost in the workpiece side which faces an adhesive layer, without an adhesive layer being cut by laser beams, a turbulent flow is started, it is decomposed thermally by laser beams and the portion of a workpiece in alignment with a turbulent flow lowers the accuracy of a cutting plane. However, since the portion of a turbulent flow will happen inside [ 51 (the adhesive layer which faces a support sheet, or an intermediate layer) ] a dicing sheet if the dicing sheet of this invention is used, cutting accuracy of a workpiece is not dropped. When the material of the mesh state which can penetrate water is used as a support sheet at this time, the turbulent flow of water becomes small and can make thin thickness of the layer (for example, adhesive layer) which can be cut with laser beams.

[0031]Since the support sheet is not cut, the workpiece after a dicing process is completed is

supported by the frame like the original state, and it can be conveyed the whole frame, without making scattering the cut workpiece (chip). By arbitrary methods, the chip cut from the workpiece exfoliates and can be taken out from a dicing sheet. The dicing sheet after dicing is extended, and after making the chip which cut the workpiece estrange mutually, it may take out by taking up a chip. In this case, the degree of fracture growth is not less than 100% as a support sheet, and when fracture stress uses the support sheet of  $50 - 30000 \text{ N/m}^2$ , the enlargement of a dicing sheet becomes possible smoothly.

[0032]

[Working example] Hereafter, although an embodiment explains this invention concretely, these do not limit the range of this invention. First, the measuring method of the composition of the "adhesive" used for the following embodiments and comparative examples, the composition of a "substrate", "optical transmittance", "ultraviolet-rays transmissivity", the "degree of fracture growth", "fracture stress", and "the state of a cutting plane" is shown.

(1), [ the acrylics copolymer (weight average molecular weight =400,000) which copolymerized and prepared manufacture 2-ethylhexyl acrylate 80 weight section of the adhesive 1, and hydroxyethyl acrylate 20 weight section ] 80-Eq isocyanate ethyl methacrylate was made to react to the hydroxyl group in the copolymer, and the polymer of pressure-sensitive adhesiveness which has a double bond of energy line polymerization nature in the side chain of said copolymer was obtained. To solid content 100 weight section of this polymer, photopolymerization initiator (1-hydroxy cyclohexyl phenyl ketone) 1 weight section, As crosslinking agent (addition of toluylene di-isocyanate and TORIMECHI roll propane) 1 weight section, and a laser-beams absorption grant agent, black paints (Dainichiseika Colour & Chemicals Mfg. [ Co., Ltd. ] Co., Ltd. make, DYMIC SZ 7740 black) 5 weight section was added, and the adhesive 1 was blended.

(2) as the manufacture support sheet of the substrate 1 -- 160 micrometers in thickness, and the degree of fracture growth (MD -- 275%) The monolayer of CD245% and the polyurethane film (film which carried out ultraviolet curing after casting urethane acrylate resin) of fracture stress ( $MD3130 \text{ N/m}^2$ ,  $CD2890 \text{ N/m}^2$ ) was used as the substrate 1.

Use the polyurethane film of the manufacture aforementioned substrate 1 of the substrate 2 as a support sheet, and, [ the one side ] [ (3) via a 5-micrometer-thick transparent 2 liquid bridge construction type acrylic pressure sensitive adhesive ] As an intermediate layer, as a laser-beams absorbency grant agent, the 70-micrometer-thick black polyvinylchloride film was laminated, and it was considered as the substrate 2 including carbon black.

(4) The transmissivity of 1064 nm of each layer of a dicing sheet was measured using the visible spectrophotometer outside measuring method purple of laser-beams transmissivity, and it was considered as laser-beams transmissivity.

(5) The transmissivity of 365 nm of the substrate of a dicing sheet was measured using the

visible spectrophotometer outside measuring method purple of ultraviolet-rays transmissivity, and it was considered as ultraviolet-rays transmissivity.

(6) Based on JISK-7127, it measured by tensile speed 200 mm/min with the measuring method omnipotent tensile test machine of the degree of fracture growth.

(7) Based on JIS K-7127, it measured by tensile speed 200 mm/min with the measuring method omnipotent tensile test machine of fracture stress.

(8) The chip after performing measuring method laser dicing of the state of a cutting plane was taken out, and the chip generated at the back of the chip was observed using the microscope. The value averaged about 20 pieces which chose the size of the chip of the maximum of the chip at random expressed the state of the cutting plane. Evaluation of the state of a cutting plane was taken as the following standard.

O ... Thing [ below 20 micrometers ] O ... It is thing [ below 40 micrometers ] x at not less than 20 micrometers... Not less than 40-micrometer thing [0033]

[Work example 1]Application dryness was carried out and the adhesive layer was formed in the exfoliation treated surface of the polyethylene terephthalate film (thickness = 38 micrometers) which carried out exfoliation processing so that the thickness after drying the combination thing of the adhesive 1 might be set to 10 micrometers. This adhesive layer was transferred on one side of the substrate 1, and the dicing sheet for laser dicing was created. The laser-beams transmissivity of each layer and the ultraviolet-rays transmissivity of a substrate are shown in Table 1.

[0034]

[Work example 2]Application dryness was carried out and the adhesive layer was formed in the exfoliation treated surface of the polyethylene terephthalate film (thickness = 38 micrometers) which carried out exfoliation processing so that the thickness after drying the combination thing of the adhesive 1 might be set to 10 micrometers. Said adhesive layer was transferred to the intermediate-layer (black polyvinylchloride film) side of the substrate 2, and the dicing sheet for laser dicing was created. The laser-beams transmissivity of each layer and the ultraviolet-rays transmissivity of a substrate are shown in Table 1.

[0035]

[Comparative Example(s)]To combination of the adhesive 1, the dicing sheet was created like Embodiment 1 except for not having added the black paints as a laser-beams absorption grant agent. The laser-beams transmissivity of each layer and the ultraviolet-rays transmissivity of a substrate are shown in Table 1.

[0036]Using the dicing sheet created by Embodiments 1 and 2 and a comparative example, 6 inch diameters and a 350-micrometer-thick silicon wafer were fixed to the ring frame for 6-inch wafers, it carried in the laser dicing apparatus, and laser dicing was performed on condition of the following.

Laser dicing apparatus : The product made by SHINOBA, Laser mu jet Laser oscillation child .  
 : YAG laser-beams wavelength : 1064 nm. Diameter of laser beams (nozzle) : 100 micrometers  
 Frequency : 700Hz pulse width : 180microsec Step : 30 micrometers Processing speed : 1260 mm/min  
 Dicing size : [ 10 mm x the 10 mm embodiments 1 and 2, and a comparative example ]  
 A silicon wafer can be changed into the state of a full cut for dicing. Since a support sheet was not cut, carrying out expanded one of the dicing sheet following dicing, and taking up a chip was able to carry out. However, the huge chip appeared in the cutting plane of the slot formed of dicing in the dicing sheet of the comparative example. A result is shown in Table 1.

[0037]

[Table 1]

	レーザー光線透過率 (%)				基材の紫外線透過率 (%)	切断面の状態
	基材			粘着剤層		
	支持シート	接着剤層	中間層			
実施例 1	9 9	—	—	6 0	6 3	○
実施例 2	9 9	9 9	5 9	6 0	4 0	◎
比較例	9 9	—	—	9 0	6 3	×

[0038]

[Effect of the Invention] The dicing sheet of this invention is applicable to laser dicing which cuts to a cutting plane and does not generate \*\*\*\* easily, without making scattering the chip which cut and formed the workpiece, can be conveyed and can perform a next process. According to the dicing method of this invention, a workpiece can be cut in high accuracy.

[Translation done.]